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(58) Field of search

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(54) Preparation of solutions

(57) A method of preparing a solution or dispersion comprises dispensing a predetermined quantity of material, such as a hazardous chemical or baby

food, into a graduated, collapsible, sealable container 1, sealing the container when collapsed partially to exclude air therefrom and to retain the container in the collapsed state, then, when required, opening the container, adding liquid to dissolve, dilute or disperse the material, and when the material has dissolved or been dispersed, making up the liquid volume to a graduation mark 2 on the container. The container is either a sachet or a concertina - shaped bottle.

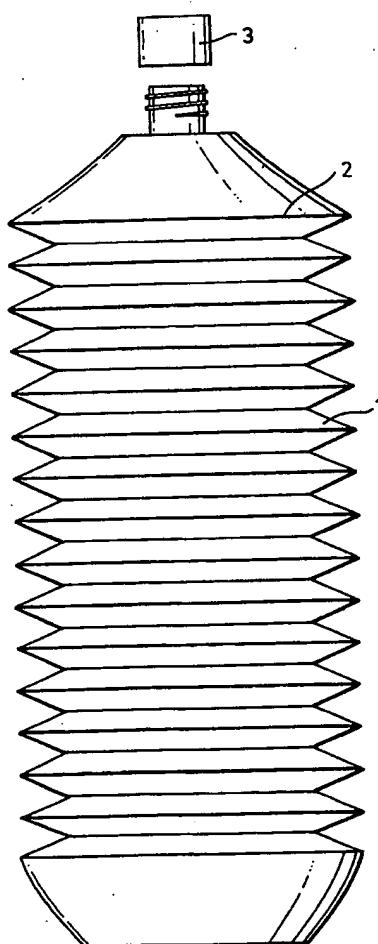


Fig.1

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The drawings originally filed were informal and the print here reproduced is taken from a later filed formal copy.

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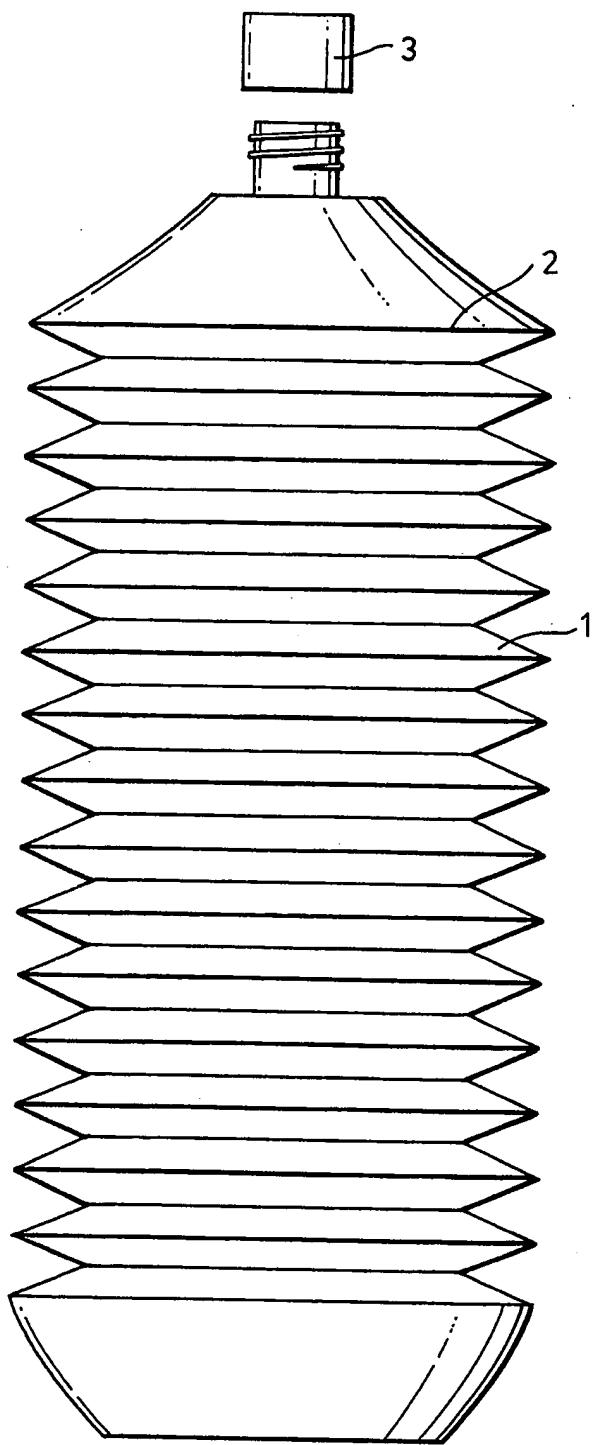


Fig.1

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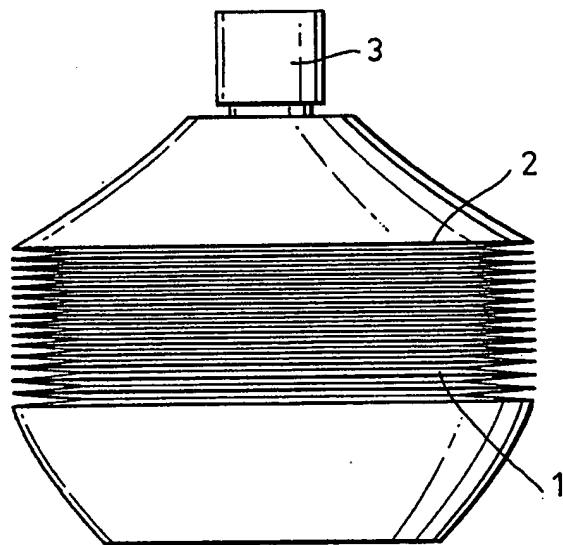


Fig.2.

## SPECIFICATION

## Preparation of solutions

5 This invention relates to the preparation of solutions and dispersions of hazardous chemicals or solid materials which require to be handled under sterile conditions.

Whilst the transportation of solid materials is 10 comparatively inexpensive it is very expensive to transport solutions of chemicals and other materials and especially dilute solutions. Often only small quantities of such dilute solutions are required and this entails packing dilute solutions of chemicals or 15 other solid materials in small containers. This means that a large volume is taken up both by the liquid, which is often water or an inflammable liquid, and by the actual containers.

However a larger number of chemicals are hazardous in that they produce hazardous dust or are 20 corrosive and thus when handling such chemicals it is preferable that the bulk solid is not handled by the persons who wish to use solutions of such chemicals but that solutions of such chemicals are prepared 25 under controlled conditions as dilute solutions of predetermined concentration ready for use. Other solid materials, for example baby foods, are required to be prepared as solutions under sterile conditions and this is difficult to achieve if the solution has to be 30 prepared in the home from bulk solid material.

We have discovered a method of preparing solutions and dispersions of hazardous chemicals or solid materials which require to be handled under sterile conditions in which no liquid or very little 35 liquid is required to be transported and in which the volume of the containers which hold the material is greatly reduced.

According to the present invention there is provided a method of preparing a solution or dispersion 40 of predetermined concentration from a liquid-soluble or dispersible material, which method comprises dispensing a predetermined quantity of the material into a graduated, collapsible, sealable container (as hereinafter defined), sealing the container 45 when the container is in the collapsed state to partially exclude air therefrom and to retain the container in the collapsed state, then, when required, unsealing the container, adding liquid to the container to dissolve, dilute or disperse the material 50 and when the material has dissolved or been dispersed making up the liquid volume to the requisite graduated volume.

By graduated, collapsible, sealable container is meant a container which can be collapsed so that the 55 volume of air present therein is not more than 1/3 of the volume of the container when containing the graduated volume of liquid, which can be sealed in an air-tight manner to retain the container in the collapsed state and which can be filled with liquid to 60 a graduation mark on the container so that the container contains a predetermined volume of liquid.

By liquid-soluble or dispersible material is meant a solid which can be dissolved or dispersed in a liquid, 65 a liquid which can be dissolved or dispersed in

another liquid or a liquid concentrate which consists of a concentrated solution of a liquid in a liquid or a solid in a liquid, the concentrate being required to be diluted at least 10 times before it is of working strength.

70 Preferably the container is composed of a transparent or translucent plastics material, e.g. polyvinyl chloride, polyethylene, polypropylene, polyester, polycarbonate or polystyrene.

75 In one aspect of the invention the container is a plastics material, for example polyethylene, sachet open at one end and which carries a graduation line indicating that when the sachet is filled with liquid to the line the sachet contains a predetermined volume

80 of liquid. A predetermined amount of material is dispensed into the sachet and the open end thereof is heat-sealed or closed by other means, for example the open end may be folded over and retained in this state by clip means. When it is required to prepare 85 the solution or dispersion the sachet is supported so that the material is at the bottom, the end which was closed is opened and liquid is introduced into the sachet to dissolve, disperse or dilute the material. When all the material has dissolved or been dispersed, sufficient liquid is added to the sachet to 90 bring the volume of solution up to the graduation mark.

In another aspect of the invention the container is a plastics material concertina bottle (such a bottle is 95 shown in the accompanying drawings) which can be sealed by, for example a screw cap or by an interference fit stopper. Towards the top of the bottle

100 there is present a graduation mark or line which indicates that when the bottle is in the uncollapsed state the bottle can contain a predetermined volume of liquid. A predetermined quantity of the material is dispensed into the bottle and the bottle is caused to collapse and the bottle is sealed. This retains the bottle in the collapsed state. When it is required to 105 prepare the working strength solution or dispersion the bottle is opened and the bottle expands when liquid is introduced therein to dissolve, disperse or dilute the material. When all the material has dissolved or has been dispersed the solution or

110 dispersion is made up to the graduation mark. In this latter aspect of the invention small volume of liquid may be added to the bottle, the bottle re-sealed and shaken to help in the dissolution or dispersion of the material. However in the aspect of the invention in

115 which a plastics material sachet is employed as the container it is preferable that if the material is solid then it is very readily soluble in the liquid and that no shaking of the container is required.

The method of the present invention is of particular use when the material is a freeze-dried granular solid, because freeze-dried solids are extremely soluble in the solvent of the solution from which the freeze-dried solid has been prepared. Other forms of powder material which are very readily soluble are 120 powders which have been prepared by spray drying and fluidised bed treatment.

In the method of the present invention a mixture of liquids may be used from which to prepare a solution, for example aqueous alcohol is a commonly used solvent. Also one liquid may be used initially 130

to dissolve or disperse the material and another miscible liquid may be used to bring the volume up to the required level. For example, acetone or ethanol may be used to dissolve all or part of a 5 material mixture, and when this has dissolved water may be added to form an organic solvent/aqueous solution of the material.

The method of the present invention is of particular use when the material of which a solution is 10 required has a very low pH or a high pH. Such materials are extremely corrosive and need to be handled with extreme care. Further, dust particles from such materials, if they be solid, should not be inhaled. Examples of solid materials which can be 15 highly acidic or alkaline are photographic processing solutions. For example, photographic developing solutions often contain sodium hydroxide. Silver-dye-bleach solutions are usually of a very low pH and often contain sulphuric acid. However, a suitable 20 solid form of sulphuric acid is the solid formed from mixing urea and sulphuric acid. This solid yields sulphuric acid when dissolved in water. It is less hazardous to use than sulphuric acid itself, nevertheless it can be described as a hazardous chemical. The 25 method of the present invention may be employed to prepare small volume solutions which comprise this material.

The method of the present invention may also be used to prepare solutions or dispersions of substances which can not be stored as solutions or which should not be handled. Examples of such materials are water-soluble or water-dispersable baby foods for very young babies. Using the method of the 30 present invention boiled or sterile water is added to 35 the container which comprises the weighed amount of baby food. The method of the present invention obviates the need to handle the prepared baby food powder.

The accompanying drawings show a concertina 40 bottle of use with the present invention.

Figure 1 is a concertina bottle 1 which holds 1000 ml of liquid when filled to the graduation line 2. The bottle is closed with a screw-on cap 3. The height of the bottle from the base to the top of the cap when 45 containing 1000 ml of liquid is 22 cm and the diameter of the bottle is 9.0 cm.

Figure 2 shows the same concertina bottle 1 when compressed with the cap 3 in position. When so compressed the volume of liquid which can be 50 contained therein is 180 ml. The height of the bottle from the base to the top of the cap is now 8 cm, the diameter remaining at 9.0 cm.

The following Examples will serve to illustrate the 55 invention.

#### Example 1

The plastic bottle of Figure 1 of expanded volume greater than 1000 ml with a 1000 ml graduation mark is charged with a powder composed of 4-60 methylaminophenol (2 g), anhydrous sodium sulphate (100 g), hydroquinone (5 g) and borax (2 g), which is stabilised according to L.F.A. Mason, "Photographic Processing Chemistry", 2nd edition, 1975, page 143 (Focal Press, New York), and the 65 bottle contracted to as small a volume as possible as

shown in Figure 2, and sealed with a screw cap. Upon removal of the cap and introducing water to the 1000 ml mark, a photographic developer solution suitable for the development of black and white 70 camera films is obtained, without the developer in its powdered or dilute form having come into contact with human skin. This is important as hydroquinone is well known to be a major cause of dermatitis.

#### 75 Example 2

A plastic concertina bottle of expanded volume greater than 125 ml and having a graduation mark at 120 ml is charged with 10 g of a powdered proprietary soya-based baby food, contracted to 30 ml and 80 sealed with a two-part cap consisting of a plastic screw-on teat and protective cover. The whole is then sterilised by passage of cobalt-60 gamma radiation, and stored until required.

On removing the cap and introducing 120 ml of 85 warm sterile water up to the graduation mark, re-screwing the cap and shaking, a sterile standard-sized meal for a baby is available for immediate usage or further storage. At no stage has the powdered food come into contact with a hand, 90 spoon or other non-sterile implement.

#### CLAIMS

1. A method of preparing a solution or dispersion of predetermined concentration from a liquid-soluble or dispersable material, which method comprises dispensing a predetermined quantity of the material into a graduated, collapsible, sealable container (as hereinbefore defined), sealing the container when the container is in the collapsed state to partially exclude air therefrom and to retain the container in the collapsed state, then, when required, unsealing the container, adding liquid to the container to dissolve, dilute or disperse the material 95 and when the material has dissolved or been dispersed making up the liquid volume to the requisite graduated volume.
2. A method according to claim 1 wherein the container is composed of a translucent or transparent plastic material.
3. A method according to claim 2 wherein the container is a sachet open at one end and which carries a graduation line.
4. A method according to claim 2 wherein the 105 sachet is composed of polyethylene and is heat sealed when the predetermined amount of material has been dispensed therein and the sachet is in the collapsed state.
5. A method according to claim 1 wherein the 110 container is a plastics material concertina bottle.
6. A method according to claim 5 wherein the concertina bottle is closed with a screw cap.
7. A method according to any one of claims 1 to 6 wherein the liquid-soluble material is freeze-dried 115 120 granular solid, a spray dried solid or a solid prepared by a fluidised bed treatment.
8. A method according to any one of claims 1 to 7 wherein the liquid-soluble material is rendered sterile when present in the container in the collapsed state.

9. A method of preparing a solution or dispersion according to claim 1 substantially as hereinbefore described with reference to the foregoing Examples.

5 10. A solution or dispersion which has been prepared by any one of the methods claimed in any one of claims 1 to 9.

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